IN THE CLAIMS

Please add new claims 20-23 as follows:

Please amend claims 1 and 18 as follows:

1. (Currently Amended) A method of self-calibrating an omni-directional camera having a reflecting surface and a lens, comprising:

capturing a sequence of omni-directional images;

tracking a feature across the sequence of omni-directional images;

defining an objective function as an error between an actual feature location and a predicted feature location; and

extracting ~~optimizing the objective function to obtain~~ a set of calibration parameters for the omni-directional camera by optimizing the objective function.

2. (Original) The method of claim 1, wherein the feature is at least one of: (a) a point; (b) a line; (c) a plane.

3. (Original) The method of claim 1, wherein tracking a feature includes tracking point features within a pair of images contained in the sequence of omni-directional images.

4. (Original) The method of claim 1, further comprising identifying pairwise correspondence of tracked features.

5. (Original) The method of claim 4, wherein defining the objective function includes finding a deviation from epipolar geometry for the identified pairwise tracked features.

6. (Original) The method of claim 1, wherein the objective function is defined based on characteristics of catadioptric imaging to relate tracked features to the set of calibration parameters.

7. (Original) The method of claim 1, wherein the objective function includes an error metric and optimizing the objective function includes minimizing the error metric.

8. (Original) The method of claim 7, wherein the error metric is an algebraic error metric.

9. (Original) The method of claim 7, wherein the error metric is an image error metric.

10. (Original) The method of claim 1, wherein the set of calibration parameters includes at least one of: (a) principal point; (b) mirror shape parameter; (c) an aspect ratio; (d) an image skew.

11. (Original) A computer-readable medium having computer-executable instructions for performing the steps recited in claim 1.

12. (Original) A method of self-calibrating a catadioptric camera system having mirrors and lenses, comprising:

obtaining a sequence of omni-directional images of a scene from the catadioptric camera;

tracking features within the scene across the sequence of omni-directional images;

characterizing epipolar geometry based on an initial set of calibration parameters;

defining an objective function as a deviation from the epipolar geometry for the tracked features; and

minimizing the objective function to obtain calibration parameters.

13. (Original) The method of claim 12, further comprising reformulating a projection equation to allow analyses to be applied in the same manner as for a rectilinear image sequence.

14. (Original) The method of claim 12, wherein the objective function includes an error metric that is defined in terms of the deviation of pairwise tracked feature correspondences from the epipolar geometry.

15. (Original) The method of claim 14, wherein the error metric is at least one of: (a) an algebraic error metric; (b) an image-based error metric.

16. (Original) The method of claim 15, wherein the image-based error metric defines an image distance to an epipolar curve.

17. (Original) The method of claim 14, wherein minimizing the objective function further comprises using an optimization technique to minimize the error metric.

18. (Currently Amended) A method for obtaining optimal calibration parameters to calibrate a catadioptric camera system, comprising:

tracking features across an image sequence captured by the catadioptric camera system;

identifying pairwise correspondence between the tracked features;

defining an objective function in terms of an error metric based deviation from epipolar geometry for the pairwise tracked features; ~~and~~

minimizing the error metric to minimize the objective function;

~~and obtain~~ extracting the optimal calibration parameters from the minimized objective function.

19. (Original) The method of claim 18, further comprising reformulating a projection equation to permit analysis subsequent to obtaining the optimal calibration parameters to be applied in the same manner as for a rectilinear image sequence.

20. (New) A method for self-calibrating a catadioptric camera, comprising:

obtaining a sequence of omni-directional images using the catadioptric camera;

tracking point features across the sequence of omni-directional images;

identifying pairwise correspondences between point features in an image pair that is two different images from the sequence of omni-directional images;

defining an objective function as an error metric defined in terms of a deviation of the pairwise correspondences from epipolar geometry of the sequence of omni-directional images;

minimizing the objective function using an optimization technique; and

finding an optimal set of calibration parameters for the catadioptric camera from the minimized objective function.

21. (New) The method of claim 20, further comprising defining the objective function by the equation:

$$\mathcal{O} = \sum_{i=1}^{N_{\text{pairs}}} \operatorname{med}_{j \subset S(b_i, e_i)} \varepsilon_{ij}$$

wherein N_{pairs} is number of different image pairs, "med" is a median of a series of errors, ε_{ij}, b_i and e_i are image numbers corresponding to the ith pair, and $S(b_i, e_i)$ is a set of indices of point feature tracks that spans across at least images b_i and e_i.

22. (New) The method of claim 21, further comprising defining ε_{ij} by the algebraic error metric given by the equation:

$$\varepsilon_{ij}^{(1)} = \left(\mathrm{q}_{j,e_i}^{\mathrm{T}} E_i \mathrm{q}_{j,b_i} \right)^2$$

23. (New) The method of claim 21, further comprising defining ε_{ij} by the image error metric given by the equation:

$$\varepsilon_{ij}^{(2)} = d^2 \left(\mathrm{q}_{j,e_i}^{\mathrm{T}}, E_i \mathrm{q}_{j,b_i} \right) + d^2 \left(\mathrm{q}_{j,b_i}^{\mathrm{T}}, E_i^{\mathrm{T}} \mathrm{q}_{j,a_1} \right)$$